

PRELIMINARY EPIDEMIOLOGY REPORT
MONTANA BRUCELLOSIS
September 19, 2008



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SUMMARY:

One of the key objectives of the voluntary Brucellosis Prevention and Surveillance Herd Management Plans completed and implemented by the Infected Herd and other livestock producers in Paradise Valley is early detection of *Brucella abortus* infections. At this time, it is apparent that only one virgin heifer in the Infected Herd was infected with *Brucella abortus*.

Epidemiological investigation focused on three possible sources of infection: other domestic cattle, wild bison (Yellowstone National Park), or free ranging elk (greater Yellowstone area-associated).

Cattle as possible source of transmission:

To investigate potential cattle to cattle transmission, the Montana Department of Livestock and USDA-APHIS-VS conducted extensive brucellosis testing of cattle epidemiologically linked to the Infected Herd (See Appendix A).

All herds within one mile of the Infected Herd were identified as Adjacent Herds and were brucellosis tested. 786 head of cattle tested negative in six Adjacent Herds (one of these herds was identified as an Adjacent Herd because they had purchased one bull from one of the Adjacent Herds).

All herds that sold cattle to the Infected Herd were identified as Source Herds and were brucellosis tested. 273 head of cattle tested negative in four Source Herds, including the infected heifer's dam and all Corriente cattle in that herd. This testing included 11 cows from one Source Herd that were re-tested prior to sale (for slaughter only). To date, all cattle from Source Herds have been tested, with the exception of eighty-eight 3-year-old heifers from one of the Source Herds.

All herds that purchased cattle from the Infected Herd within the last two years were identified as Trace Herds. These purchases were through private treaty sales, production sales, or livestock markets. To date, 35 head of cattle have tested negative in eleven Trace Herds. Additionally, seven animals were purchased by slaughter plants or slaughter buyers – verification of slaughter pending. To date, investigations continue regarding nine animals traced to six Trace Herds. Of these, three of the animals in two Trace Herds have been identified and isolated – tests pending.

All herds that had short-term contact or commingling with cattle from the Infected Herd were identified as Exposed Herds. All exposed cattle in the herds identified as Exposed Herds have tested negative - 14 head of cattle in three herds.

The extensive brucellosis testing of cattle to date has not found additional brucellosis infected livestock, so there is no evidence to suggest the infection was due to cattle-to-cattle transmission. Similarly, there is no evidence to suggest that there was any further spread of the infection to other cattle in the Infected Herd, to cattle in Adjacent Herds, to cattle traced out of the Infected Herd, or to other potentially exposed cattle. The Montana Department of Livestock and USDA-APHIS-VS will continue to explore all possible cattle sources of infection. All Adjacent Herds and Source Herds (sources of herd additions) will be subject to herd assurance tests (approximately 6 months following the initial negative herd tests). Similarly, the agencies will continue to investigate all sexually intact cattle removed from the herd during the last two years. All female cattle traced out of the herd will be subject to an assurance test (approximately 6 months following their initial negative test).

Summary of Testing (as of September 19, 2008)	
# Source Herds Tested	4
# Cattle Tested - Source Herds * Includes assurance testing of 29 head of cattle re-tested prior to sale.	*291
# Adjacent Herds Tested * * Includes 1 herd that purchased a bull from an Adjacent Herd	**6
# Cattle Tested - Adjacent Herds	786
# Herds With Exposed Cattle Tested	3
# Cattle Tested - Exposed Herds	14
# Herds With Trace-out Cattle Tested	12
# Cattle Tested - Trace-outs (includes out-of-state traces)	37
NUMBER OF CATTLE TESTED - TOTAL	1,128

In addition to the extensive brucellosis testing conducted of cattle epidemiologically linked to the Infected Herd, the Montana Department of Livestock and USDA-APHIS-VS investigated the parentage of the infected Corriente heifer. Hair samples from the Corriente cow presented as the dam of the infected heifer and tissue samples from the infected Corriente heifer were submitted to the Veterinary Genetics Laboratory at the University of California, Davis for parentage analysis. DNA analysis of the hair and tissue samples confirmed the infected heifer (81TUG0218) was the offspring of the cow presented as her dam (81AYJ3152) (See Appendix B).

Although the Infected Herd consisted of Corriente cattle, all were native to the United States. There is no apparent epidemiological link to Mexican or "M-Branded" cattle. The infected heifer, as well as her herd mates, originated from Montana. Additionally, the dam of the infected heifer, currently in another herd, recently tested negative. At this time, it appears to be nothing more than coincidence that both this herd, as well as the herd affected with brucellosis in 2007, had Corriente cattle.

The National Veterinary Services Laboratory (NVSL), Ames, Iowa, recovered and genotyped five *Brucella abortus* biovar 1 isolates from the infected Corriente heifer. The genotyping analysis examined 23 separate loci within the *Brucella* genome of these isolates. The genotypes of these isolates were compared to the genotypes of 46 different *Brucella abortus* isolates, including isolates from cattle, bison, and elk.

- The cattle isolates included those from the 2007 Montana Infected Herd as well as cattle isolates from Idaho, South Dakota, and Texas.
- The bison isolates included those from culture-positive Yellowstone National Park (YNP) bison in 2005, 2006, and 2008.
- The elk isolates were all from elk in the GYA, including those from *Brucella abortus* culture-positive Idaho elk in 2002, 2003, 2004, and 2005 and from *Brucella abortus* culture-positive Montana elk in 2008. The 2008 Montana elk isolates were from elk harvested during the late hunt near Gardiner, Montana.

Comparison of these various isolates indicated the Montana bison, elk, and cattle strains were more closely related than strains from other areas of the country and that the *Brucella abortus* strain recovered from the infected Corriente heifer appears to be similar to strains recovered from bison and elk in the Montana GYA (See Appendix C).

Bison as possible source of transmission:

Bison from YNP were evaluated as a possible source of the *Brucella abortus* infection in the Corriente heifer. The comparison of various *Brucella abortus* genotypes from culture-positive bison in the

Montana GYA were closely related to the genotype of the *Brucella abortus* isolates from the Corriente heifer detected in 2008. However, for transmission to occur between YNP bison and cattle, cattle must be in close proximity to bison or the landscape bison occupy. There is no evidence to indicate close proximity of the Infected Herd to YNP bison or the landscape YNP bison may have occupied. YNP bison, including those in the Bison Quarantine Feasibility Study and any bison egressing from YNP have never been closer than approximately 20 miles to the Infected Herd. As such, there is no evidence to suggest that YNP bison were the source of the *Brucella abortus* infection in the Corriente heifer.

Elk as possible source of transmission:

As reported by the herd owner and other livestock producers in the area, approximately 400-500 head of elk winter in the area. Though direct commingling with cattle was not observed by any of the livestock producers in the area, elk would frequently pass through the Infected Herd premises, as well as other adjacent premises. In addition, the elk would pass through pastures that cattle had access to at the same time. Additionally, in early June, elk calve on or near the Infected Herd and on or near other adjacent premises. The brucellosis seroprevalence of this local herd is unknown at this time. In 2007 and 2008, the seroprevalence for elk in the Paradise Valley (Northern Yellowstone Elk Management Unit - hunting districts 313, 314, 316, and 317) was 5.6% (n=89). Additional brucellosis surveillance of the local elk herd is indicated to determine if it may have been the source of the infection.

Genetic analysis from the National Veterinary Services Laboratory (NVSL) reported that the *Brucella abortus* bacteria isolated from Montana's livestock cases in 2007 and 2008 are most similar to *Brucella abortus* strains isolated from wildlife in the GYA (Appendix C). The recent genetic analysis, combined with other epidemiological information described above, strongly suggests wild, infected elk as the source of brucellosis transmission to livestock.

BACKGROUND ON INFECTED HERD:

The Infected Herd is located in Pray, MT, in the Paradise Valley, approximately 17 miles south of Livingston, and approximately 24 miles north of Yellowstone National Park. The Infected Herd has a purebred Corriente herd, started in 2005, consisting of 34 animals, including 11 adult cows, 13 2-yr-old heifers, 1 3-yr-old bull, 2 yearling bulls, and 8 calves (2008 crop - 6 steers and 2 spayed heifers). Prior to starting up the purebred Corriente herd, the Infected Herd had a purebred Red Angus herd. The Red Angus herd was dispersed in 2007, through a production sale, private treaty sales, and through livestock markets.

The Infected Herd is one of thirty-one ranches in the Paradise Valley that have completed and are implementing greater Yellowstone area (GYA) Brucellosis Prevention and Surveillance Herd Management Plans. On May 15, 2008, herd testing and adult vaccination were conducted as components of the Infected Herd's voluntary Brucellosis Prevention and Surveillance Herd Management Plan. All sexually intact animals 18 months of age and older were brucellosis tested and adult vaccinated (*Brucella abortus* strain RB51). One reactor (2-yr-old heifer: Ranch tag 601, USDA Tag 81TUG0218) was detected during the May 15, 2008 herd test. (BAPA - positive; FPA - positive, Rivanol - I 100). Serum samples from the reactor were forwarded to the National Veterinary Services Laboratory (NVSL) for confirmatory testing. (Complement Fixation - 3+ 1:160; PCFIA - 0.196; and Western Blot - "Likely *Brucella* species exposed").

On May 27, 2008, the reactor was euthanized at the Montana Department of Livestock's Veterinary Diagnostic Laboratory, Bozeman, MT, and tissues were collected and forwarded to NVSL for further diagnostics. On June 9, 2008, NVSL confirmed the isolation *Brucella abortus* biovar 1 from the submitted tissues and the herd subsequently classified as an infected herd. The infected heifer was not pregnant and had never calved. The Infected Herd was quarantined on May 19, 2008 and remains under quarantine. On August 7, 2008, herd depopulation was initiated – eleven (11) adult Corriente cows were transported to slaughter (all negative on MCI testing at slaughter). On August 27, 2008, herd

depopulation was completed – 12 adult Corriente cows and 3 Corriente bulls were transported to slaughter (all negative on MCI testing at slaughter). The following is a summary of the timeline regarding this infected herd:

- April 1, 2008 – Voluntary Brucellosis Prevention and Surveillance Herd Management Plan completed.
- May 15, 2008 – Herd testing / Adult vaccination conducted as per Herd Plan– 1 Reactor detected.
- May 27, 2008 – Reactor euthanized – Diagnostic samples to NVSL.
- June 9, 2008 – NVSL confirms isolation of *Brucella abortus* biovar 1 from submitted tissues.
- August 7, 2008 – Partial herd depopulation – 11 Corriente cows to slaughter - all negative on MCI testing at slaughter.
- August 27, 2008 – Herd depopulation completed – 12 Corriente cows and 3 Corriente bulls to slaughter – all negative on MCI testing at slaughter.

Elk Contact:

The owner of the Infected Herd, as well as neighboring ranch owners, estimates up to 400-500 head of elk from a local elk herd winter in the area. The brucellosis seroprevalence of this local herd is unknown at this time. In 2007 and 2008, the seroprevalence for elk in the Paradise Valley (Northern Yellowstone Elk Management Unit - hunting districts 313, 314, 316, and 317) was 5.6% (n=89). There is no evidence the local elk herd intermingled with cattle on the Infected Herd, however, the elk pass through the premises frequently, from September through May, and utilize the pastures for grazing. Additionally, in early June elk calve on or near the ranch.

SOURCE HERDS SUMMARY / HERD ADDITIONS:

Herd additions (sexually intact cattle) to the Infected Herd since 2005 were primarily purebred Corriente cattle, from three different sources. Other herd additions of sexually intact cattle included bull calves (Charolais) from one additional source. These bull calves were subsequently castrated following arrival at the Infected Herd.

Producer A, Park County, MT

The Infected Herd purchased the following sexually intact cattle from Producer A via private treaty sales:

- April 26, 2005 - 3 yearling Corriente heifers.
- February 4, 2007 – 10 yearling Corriente heifers, including reactor heifer (Ranch tag 601, USDA Tag 81TUG0218).
- March 14, 2006 – 2 yearling Corriente heifers and 6 yearling Corriente bulls. (5 of the yearling bulls were subsequently castrated at branding).
- March 12, 2008 – 8 adult Corriente cows.

Producer A's herd consists of 29 sexually intact Corrientes cattle and approximately 600 Angus cattle. The Corriente cattle and Angus cattle are managed as separate herds. The following summarizes actions taken (as of September 4, 2008):

- June 10, 2008 – Quarantine issued on Producer A's Corriente herd and 88 3-year-old Angus heifers with calves at side.
- June 13, 2008 – Corriente herd test conducted – all negative (29 sexually intact animals, including 25 cows, 3 yearling heifers, and 1 bull). Included in this negative herd test was the dam (81AYJ3152) of the Infected Herd reactor.
- July 15, 2008 – Producer A sold 11 adult Corriente cows at PAYS - SLAUGHTER ONLY. All tested (negative) prior to sale. All previously test-negative (6-13-08 herd test).
- August 6, 2008 - DNA analysis, conducted at the University of California, Davis, of tissues from the reactor heifer and hair samples from the dam confirmed the reactor animal (81TUG0218) was the offspring of the dam (81AYJ3152).

- September 15, 2008 – Assurance testing conducted on 18 Corriente cattle (17 cows, 1 bull) – All negative. 6 of these cows and 1 bull to be sold 9-17-08 at PAYS – SLAUGHTER ONLY. 11 cows Adult vaccinated – sold to Infected Herd.
- September 15, 2008 – Status – **Active**, Assurance Tests Pending.
 - The 3-yr-old Angus heifers and their calves are currently out on mountain pasture. To be gathered and tested September 30 or October 3, 2008.

Producer B, Park County, MT

The Infected Herd purchased the following sexually intact cattle from Producer B via a private treaty sale:

- November 7, 2007 – 3 Corriente heifer calves (2006) and 1 Corriente cow.

The following summarizes actions taken (as of September 4, 2008):

- June 10, 2008 - Producer B's herd quarantined.
- June 11, 2008 - Partial herd test conducted – all negative (12 yearling Corriente heifers and 1 Corriente bull).
- June 20, 2008- The remainder of the Producer B's herd was tested – all negative (15 Corriente cows).
- September 4, 2008 – Status – **Active**, Herd Assurance Test Pending.

Producer C, Fallon County, MT

The Infected Herd purchased the following sexually intact cattle from Producer C via a private treaty sale:

- July 23, 2007 – 6 Corriente bull calves (2007). 4 castrated upon arrival at Infected Herd, 2 remained sexually intact.

The following summarizes actions taken (as of September 4, 2008):

- July 12, 2008 - Entire herd test conducted – all negative (190 head of sexually intact Corriente cattle, including 158 cows, 26 yearling heifers, and 6 bulls).
- July 12, 2008 – Verbal quarantine release, Herd Plan in place.
- September 4, 2008 – Status – **Active**, Herd Assurance Test Pending.

Producer D, Bannock County, ID

Infected Herd purchased the following sexually intact cattle from Producer D via a private treaty sale:

- June 15, 2007 – 6 Charolais bull calves (2007). All 6 were subsequently castrated upon arrival at Infected Herd).

The following summarizes actions taken (as of September 4, 2008):

- June 17, 2008 - Entire herd test – all negative (15 sexually intact animals).
- September 4, 2008 – Status – Closed - Referred to Idaho Animal Health Officials.

<u>Sources of Herd Additions Testing Summary</u> (as of September 19, 2008)	
Number of herds identified as sources of herd additions to Infected Herd	4
Number of cattle tested in herds identified as sources of Infected Herd additions * Includes assurance testing of 29 head of cattle from one Source Herd re-tested prior to sale.)	* 291

AREA / ADJACENT HERDS:

All area herds within one mile from any fence line of the Infected Herd were identified as Adjacent Herds. All of the Adjacent Herds had completed and were implementing greater Yellowstone area Brucellosis Prevention and Surveillance Herd Management Plans at the time the reactor was discovered in the Infected Herd. All of the Adjacent Herds were quarantined following the disclosure of the reactor in the Infected Herd and remained under quarantine until entire herd tests were completed and their herd plans amended to reflect additional testing requirements.

Producer E, Park County, MT

Producer E has fence line contact with the Infected Herd.

- June 10, 2008 – Producer E's herd quarantined.
- June 19, 2008 – Entire herd test conducted – all negative (155 sexually intact animals, including 127 cows, 20 yearling heifers, and 8 bulls).
- July 1, 2008 – Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed – verbal release of quarantine.
- July 11, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer F, Park County, MT

Producer F has fence line contact with the Infected Herd.

- May 21, 2008 – 5 cows tested – all negative – prior to sale at a Montana livestock market (as per Producer F's voluntary Brucellosis Prevention and Surveillance Herd Management Plan).
- June 10, 2008 - Producer F's herd quarantined.
- June 12, 2008 - Partial herd test conducted – all negative (135 sexually intact animals, including 113 cows, 17 yearling heifers, and 5 bulls).
- June 16, 2008 - Remainder of Producer F's herd tested – negative (1 bull).
- July 1, 2008 – Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed.
- July 11, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer G, Park County, MT

Producer G runs cattle seasonally on Producer F's premises and has fence line contact with the Infected Herd.

- June 10, 2008 - Producer G's herd quarantined (included in Producer F's quarantine).
- June 11, 2008 - voluntary Brucellosis Prevention and Surveillance Herd Management Plan signed – included provision for follow-up assurance test.
- June 12, 2008 - Entire herd test conducted – all negative (18 sexually intact animals, including 12 cows and 6 yearling heifers).
- July 11, 2008 – Quarantine released.
- August 20, 2008 – Approval granted to relocate herd to isolated pasture in Shield's Valley.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer H, Park County, MT

Producer H has fence line contact with the Infected Herd.

- June 10, 2008 - Producer H's herd quarantined.
- June 12, 2008 - 1 cow and 2 bulls tested – all negative – prior to sale at a Montana livestock market (as per Producer H's voluntary Brucellosis Prevention and Surveillance Herd Management Plan).
- June 17, 2008 - Entire herd test conducted – all negative (223 sexually intact animals, including 147 cows, 66 yearling heifers, and 11 bulls. 1 steer was also included in the negative herd test).
- July 1, 2008 – Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed.
- July 11, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer I, Park County, MT

Producer I has fence line contact with the Infected Herd and purchased animals (trace outs) from the Infected Herd.

- May 15, 2008 – 7 cows tested – all negative - prior to sale at a Montana livestock market (as per Producer I's voluntary Brucellosis Prevention and Surveillance Herd Management Plan).
- June 10, 2008 - Producer I's herd quarantined.
- July 9, 2008 - Entire herd test conducted – all negative (237 sexually intact animals).
- July 18, 2008 – Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed.
- August 6, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer J, Park County, MT

Producer J purchased one bull from Producer H and the bull was still on Producer H's premises at the time the Infected Herd was disclosed.

- June 18, 2008 – Producer J's bull quarantined.
- June 18, 2008 – Bull tested – negative (included in Producer H's entire herd test).
- July 1, 2008 - Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed.
- July 11, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - assurance test of purchased bull is planned approximately 6 months following the initial test.

Area and Adjacent Herds Testing Summary (as of September 19, 2008)	
Number of herds identified as Area/Adjacent Herds * Includes 1 herd that purchased a bull from an Adjacent Herd	* 6
Number of cattle tested in Area/Adjacent Herds	786

ANIMALS REMOVED FROM INFECTED HERD (TRACE OUTS):

All animals removed from the Infected Herd within two years of the May 15, 2008 herd test date were identified as Trace Outs. The majority of the Trace Outs were Red Angus cattle, due to the dispersion of the Infected Herd's Red Angus cattle in 2007; sold via a production sale, private treaty sales, and through livestock markets. All Trace Outs identified will be tested at least once. (All Trace Out bulls will be tested once. All Trace Out heifers or cows will be tested twice, with the second test as an additional assurance test to ensure no potential for further spread of disease).

MONTANA TRACE OUTS:

Producer I, Park County, MT

In addition to being identified as an Adjacent Herd, Producer I also purchased the following Red Angus cattle from Infected Herd between January 15, 2007 and December 10, 2007:

- Five bred Red Angus cows
- One Red Angus yearling heifer
- Two Red Angus heifer calves

The following summarizes actions taken (as of September 4, 2008):

- May 15, 2008 – 7 cows tested – all negative - prior to sale at a Montana livestock market - including 1 of the above purchased cows (as per Producer I's voluntary Brucellosis Prevention and Surveillance Herd Management Plan).
- June 10, 2008 - Producer I's herd quarantined.
- July 9, 2008 - Entire herd test conducted – all negative (237 sexually intact animals - including 8 of the above purchased animals or their 2007 calves).
- July 18, 2008 – Addendum to Brucellosis Prevention and Surveillance Herd Management Plan signed.
- August 6, 2008 – Quarantine released.
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Amended Brucellosis Prevention and Surveillance Herd Management Plan is in place - herd assurance test is planned approximately 6 months following the initial herd test.

Producer K, Park County, MT

- July 23, 2007 - Producer K purchased a 4-yr-old Red Angus cow with heifer calf at side.
- November 2007 thru March 2008 - This cow/calf pair returned to Infected Herd for grazing purposes and subsequently returned to Producer K's premises.
- June 10, 2008 - Producer K's herd quarantined.
- June 16, 2008 - Entire herd test conducted – all negative (5 head – including the purchased cow and her 2007 heifer calf).
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - The herd remains under quarantine and an assurance test is planned approximately 6 months following the June 16, 2008 herd test.

Producer L, Stillwater County, MT.

- May 16, 2007 - Producer L purchased eight Red Angus cow/calf pairs from Infected Herd.
- June 14, 2008 - Producer L's herd quarantined.
- July 1, 2008 – Entire herd test conducted – all negative (14 head, including all purchased animals, excluding two of the calves (1 steer calf and 1 bull calf that died after arrival at Producer L's premises)).
- September 4, 2008 – Status – Active, Herd Assurance Test Pending.
 - Herd plan in place – herd assurance test is planned approximately 6 months following the July 1, 2008 testing date.

Producer M, Lewis and Clark County, MT.

- April 23, 2007 - Producer M purchased one 3-yr-old Red Angus cow from the Infected Herd (via Headwaters Livestock).
- June 17, 2008 - Producer M's herd quarantined.
- June 28, 2008 - The purchased cow was tested - negative.
- September 4, 2008 – Status – Active, Assurance Test Pending.
 - The cow remains under quarantine and an assurance test is planned approximately 6 months following the 6/28/2008 test.

Producer N, Carter County, MT.

- October 31, 2007 – Producer N-1 purchased two Red Angus heifer calves from the Infected Herd (via Headwaters Livestock).
- May 15, 2008 – Producer N subsequently purchased the two animals from Producer N-1.
- September 4, 2008 – Status – Active, Investigation Ongoing.
 - The two heifers are currently out on pasture as stocker heifers. Producer N is in the process of trying to locate and identify the two heifers. However, Producer N may not be able to present the two heifers for identification and testing until late September or early October 2008 when all stocker cattle are gathered for shipping.

Producer P, Phillips County, MT.

- March 14, 2005 - Producer P purchased one 1-yr-old Red Angus bull from the Infected Herd.
- June 17, 2008 – Bull quarantined.
- June 21, 2008 - The purchased bull was tested - negative.
- June 25, 2008 – Quarantine released.
- September 4, 2008 – Status – Closed, No Further Action Warranted.
 - The animal was tested prior to the MT DOL / APHIS / MT DBE joint recommendation to only follow-up and test Trace Outs within 2 years prior to the date of disclosing the reactor (May 15, 2008).

Producer Q, Blaine County, MT.

- December 10, 2007 – Producer Q-1 purchased two Red Angus cows, one 3-yr-old and one 4-yr-old, from the Infected Herd (via Headwaters Livestock).
- December 31, 2007 - Producer Q subsequently purchased the two Red Angus cows from Producer Q-1.
- September 5, 2008 – Both purchased cows tested – negative.
- September 5, 2008 – Status – Active, Slaughter Pending.
 - Cows will be sold directly to slaughter after calves are weaned this fall.

Producer R, Wheatland County, MT.

- October 14, 2006 - Producer R purchased one 1-yr-old Red Angus heifer (via NILE Sale, Billings, MT).
- June 25, 2008 – Quarantine issued.
- July 7, 2008 - The heifer was tested – negative.
- September 4, 2008 – Status – Active, Assurance Test Pending
 - The heifer remains under quarantine and an assurance test is planned approximately 6 months following the July 7, 2008 test.

Producer S, Beaverhead County, MT.

- March 8, 2007 - Producer S purchased one 1-yr-old Red Angus bull (Production Sale).
- July 2, 2008 - Quarantine issued.
- July 2, 2008 - The purchased bull was tested – negative.

- July 16, 2008 – Quarantine released.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer T, Daniels County, MT.

- March 8, 2007 - Producer T purchased one 1-yr-old Red Angus bull (Production Sale).
- June 30, 2008 - Quarantine issued.
- July 11, 2008 – The purchased bull was tested – negative.
- July 14, 2008 – Verbal quarantine release.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer U, Fergus County, MT.

- April 26, 2007 - Producer U purchased one 1-yr-old Red Angus bull (via PAYS – Grasstime Sale).
- June 30, 2008 – Quarantine issued.
- July 24, 2008 – The purchased bull was tested – negative.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer V, Lake County, MT.

- March 28, 2007 – Producer V-1 purchased one 1-yr-old Red Angus bull (via Headwaters Livestock).
- April 9, 2007 – Producer V subsequently purchased the bull from Producer V-1 (via Headwaters Livestock).
- July 8, 2008 – Quarantine issued.
- July 22, 2008 – The purchased bull was tested – negative.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer W, Ravalli County, MT

- September 25, 2006 – Producer W-1 purchased one Infected Herd 1-yr-old Corriente heifer (via Headwaters Livestock).
- September 26, 2006 – Producer W-2 subsequently purchased the Corriente heifer from Producer W-1 (via Montana Livestock Auction, Ramsey, MT).
- September 28, 2006 – Producer W subsequently purchased the Corriente heifer from Producer W-2 (via Missoula Livestock Exchange).
- November 30, 2006 – Producer W “no-saled” the Corriente heifer at Missoula Livestock Exchange.
- July 12, 2007 – Producer W sold Corriente heifer to slaughter buyer (O & S Cattle Company, S. St Paul, MN - via Missoula Livestock Exchange). Heifer was subsequently slaughtered at Valley Pride, Norwalk, WI.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer X, Gallatin County, MT

- September 25, 2006 - Producer X purchased one 1-yr-old Corriente heifer (via Headwaters Livestock).
- September 4, 2008 – Status – Active, Investigation Ongoing.
 - Producer X may still have the heifer, out on pasture, or may have subsequently sold the heifer in January or February 2007 (via PAYS or Headwaters Livestock). Producer X will try to locate and identify the heifer when cattle are gathered this fall.

Producer Y, Judith Basin County, MT

- September 11, 2006 - Producer Y purchased one 1-yr-old Red Angus heifer (via Headwaters Livestock).
- January 16, 2007 – Producer Y sold heifer direct to slaughter (Excel, Ft. Morgan, CO).
- September 4, 2008 – Status – Closed, No Further Investigation Warranted.

Producer Y, Judith Basin County, MT

- April 23, 2007 – Producer Y purchased two 1-yr-old Red Angus bulls (via Headwaters Livestock) as feeders.
- September 4, 2008 – Status – **Active**, Investigation Ongoing.

OUT-OF-STATE TRACE OUTS:**Producer XW, Wyoming**

- March 8, 2007 - Producer XW purchased four 1-yr-old Red Angus heifers (Production Sale).
- July 20, 2008 – Entire herd test conducted – all negative (including the four purchased heifers).
- September 4, 2008 – Status – Referred to Wyoming Animal Health Officials.
 - Wyoming animal health officials may conduct an assurance test approximately 6 months following the July 20, 2008 herd test.

Producer XH, Hawaii

- March 8, 2007 - Producer XH purchased one 1-yr-old Red Angus heifer (Production Sale).
- July 17, 2008 – Hawaii animal health officials identified and isolated the heifer. Heifer expected to calve in August – will be bled approximately 30 days post-calving.
- September 4, 2008 – Status – Referred to Hawaii Animal Health Officials
 - Heifer identified and isolated. Post-calving test pending.

Producer XN, North Dakota

- March 8, 2007 - Producer XN purchased one 1-yr-old Red Angus heifer (Production Sale).
- July 1, 2008 – Heifer tested – negative.
- September 4, 2008 – Status – Referred to North Dakota Animal Health Officials.
 - North Dakota animal health officials may conduct an assurance test approximately 6 months following the July 1, 2008 test.

Producer XI, Idaho

- March 8, 2007 - Producer XI purchased one 1-yr-old Red Angus bull (Production Sale).
- July 22, 2008 – Bull is out on pasture.
- September 4, 2008 – Status – Referred to Idaho Animal Health Officials.
 - Bull to be identified and tested early fall 2008.

SLAUGHTER CHANNELS:**Slaughter Buyer A, Jerome, Idaho**

- March 12, 2007 - Slaughter Buyer A purchased two Red Angus cows (via Headwaters Livestock).
- September 4, 2008 – Status – **Active**, Slaughter Verification Pending.

Slaughter Plant B, Hot Springs, South Dakota

- April 16, 2007 - Slaughter Plant B purchased one Red Angus cow (via Headwaters Livestock).
- September 4, 2008 – Status – **Active**, Slaughter Verification Pending.

Slaughter Plant C, Woodland, Washington.

- April 16, 2007 - Slaughter Plant C purchased one Red Angus cow (via Headwaters Livestock).
- May 22, 2007 – Slaughter Plant C purchased one Red Angus cow (via Headwaters Livestock).
- September 4, 2008 – Status – **Active**, Slaughter Verification Pending.

Slaughter Plant D, Long Prairie, Minnesota

- April 16, 2007 - Slaughter Plant D purchased one Red Angus cow (via Headwaters Livestock).
- May 22, 2007 - Slaughter Plant D purchased one Red Angus cow (via Headwaters Livestock).
- September 4, 2008 – Status – **Active, Slaughter Verification Pending.**

Summary of Testing – Traces Out of Infected Herd (as of September 19, 2008)	
Number of herds tested with trace-out cattle	12
Number of cattle tested in trace-out herds	37

OTHER EXPOSED ANIMALS:**Producer ER-1, Park County, MT**

- June 2007 - Producer ER-1 brought eight head of Corriente roping cattle (5 heifers, 1 bull, and 2 steers) to Infected Herd for approximately two days. These animals were commingled with Infected Herd Corriente roping cattle.
- November 30, 2007 - Producer ER-1 subsequently sold all 8 animals at PAYS, Billings, MT.
 - The five heifers were purchased by Producer ER-2 (see below).
 - The bull and 2 steers were purchased by Producer ER-3 (see below).
- September 4, 2008 – Status – Closed, Traced to Other Premises.

Producer ER-2, Yellowstone County, MT

- November 30, 2007 - Producer ER-2 purchased five exposed Corriente roping heifers from Producer ER-1 (via PAYS).
- July 21, 2008 – Purchased Corriente heifers tested – all negative.
- September 4, 2008 – Status – **Active, Assurance Test Pending.**
 - An assurance test of these heifers is planned approximately 6 months following the July 21, 2008 test.

Producer ER-3, Yellowstone County, MT

- November 30, 2007 – Producer ER-3 purchased two Corriente steers and one Corriente bull from Producer ER-1 (via PAYS). The bull was subsequently neutered after arrival at Producer ER-3's premises.
- February 9, 2008 – Producer ER-3 subsequently sold all three exposed roping steers at Burke Livestock, Burke, SD.
- August 7, 2008 – South Dakota animal health officials verified all animals sold were steers.
- September 4, 2008 – Status – Closed, No Further Action Warranted.

Producer ER-4, Fergus County, MT

- March 24, 2008 thru May 10, 2008 - Producer ER-4 brought 14 head of Corriente (8 heifers and 6 steers) roping cattle to Dillon, MT, where they were commingled with 6 head of Corriente roping cattle (5 heifers and 1 steer) from the Infected Herd.
- May or June 2008 – Producer ER-4 subsequently sold all 14 animals (Private Treaty) as follows:
 - Producer ER-5 – purchased 6 heifers (see below).
 - Producer ER-6 – purchased 2 heifers and 6 steers (see below).
- September 4, 2008 – Status – Closed, Traced to Other Premises.

Producer ER-5, Beaverhead County, MT

- May or June 2008 – Producer ER-5 purchased six exposed Corriente roping heifers from Producer ER-4.

- July 16, 2008 – Purchased heifers tested – all negative.
- September 4, 2008 – Status – **Active**, Assurance Tests Pending.
 - An assurance test of these heifers is planned approximately 6 months following the July 16 2008 test.

Producer ER-6, Fergus County, MT

- May or June 2008 – Producer ER-6 purchased eight exposed Corriente roping cattle (2 heifers and 6 steers) from Producer ER-4.
- July 24, 2008 – Purchased heifers tested – both negative.
- September 4, 2008 – Status – **Active**, Assurance Test Pending.
 - An assurance test of these heifers is planned approximately 6 months following the July 24, 2008 test.

Summary of Testing – Other Exposed Animals (as of September 19, 2008)	
Number of herds with Exposed Animals tested	3
Number of cattle tested in Exposed Herds	14

CONCLUSION:

After reviewing the circumstances associated with the brucellosis-infected Corriente heifer detected in Montana in 2008, cattle to cattle and YNP bison to cattle transmissions are highly unlikely. At this time, the most compelling evidence suggests elk in the Montana GYA were the most likely source of the brucellosis transmission. Additional brucellosis surveillance of elk in the Paradise Valley, especially the local elk herd close to the Infected Herd, is clearly warranted.

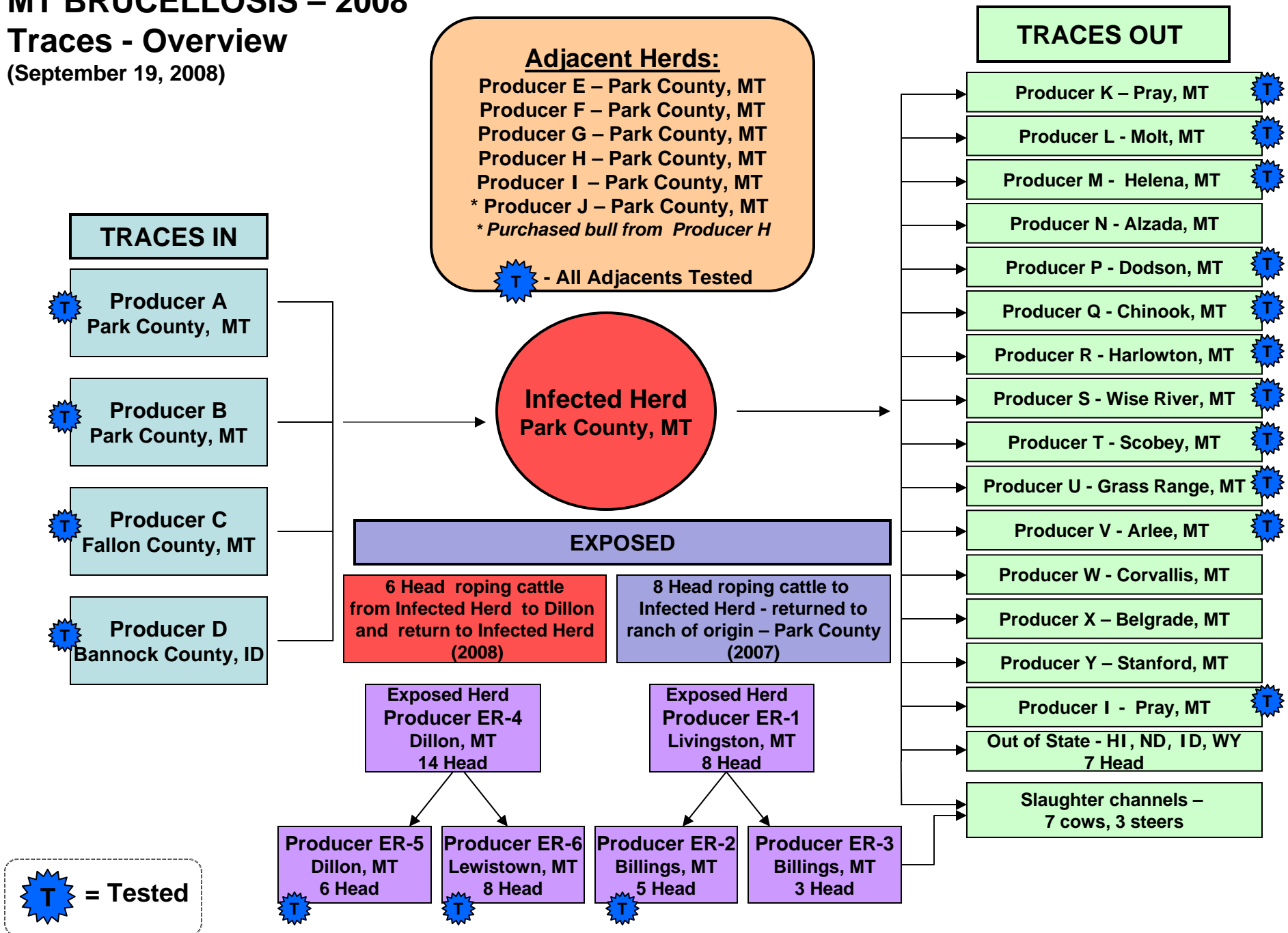
The Montana Department of Livestock and USDA-APHIS-VS will continue to their investigation of livestock, including follow-up assurance testing of all cattle epidemiologically linked to the Infected Herd. Livestock producers in Paradise Valley will continue to implement brucellosis mitigation and detection strategies as per their Brucellosis Prevention and Surveillance Herd Management Plans.

APPENDIX A: Epidemiology Charts for Cattle Testing

MT BRUCELLOSIS – 2008

Traces - Overview

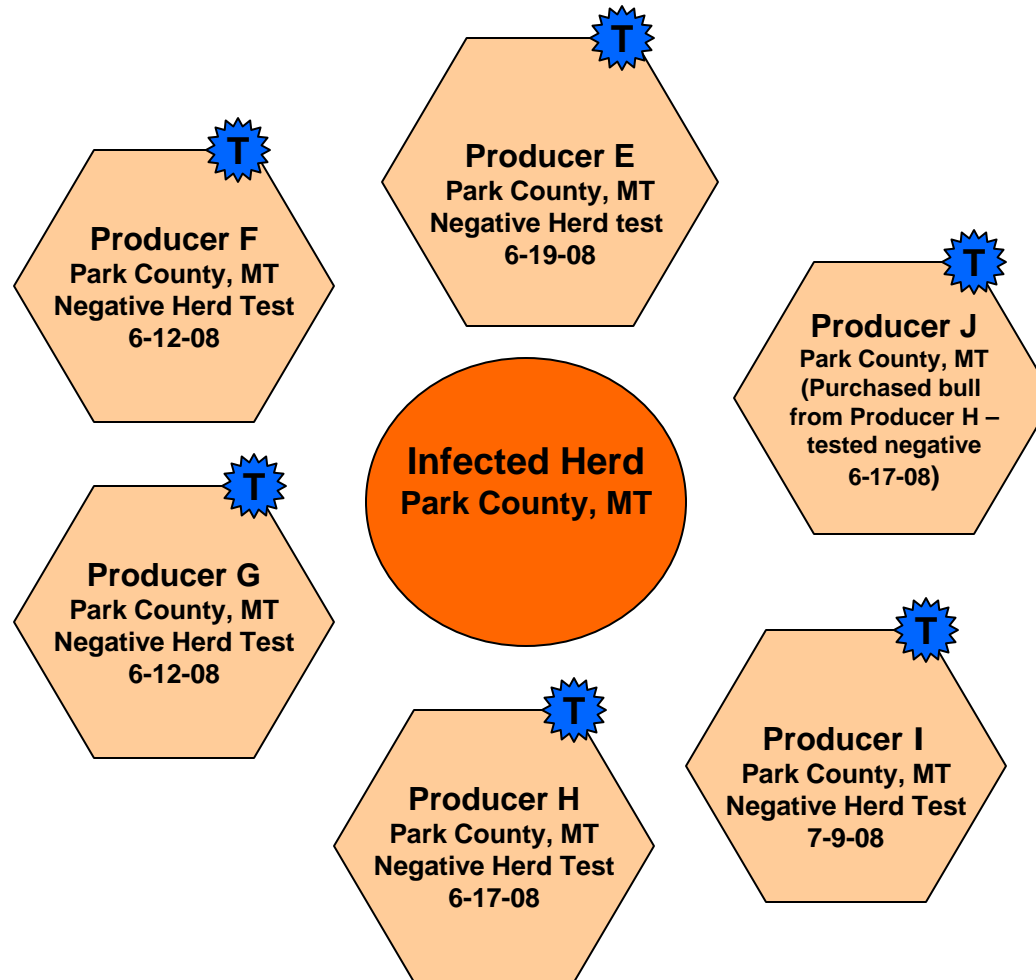
(September 19, 2008)



MT BRUCELLOSIS – 2008

Herds Adjacent to Infected Herd

(September 19, 2008)




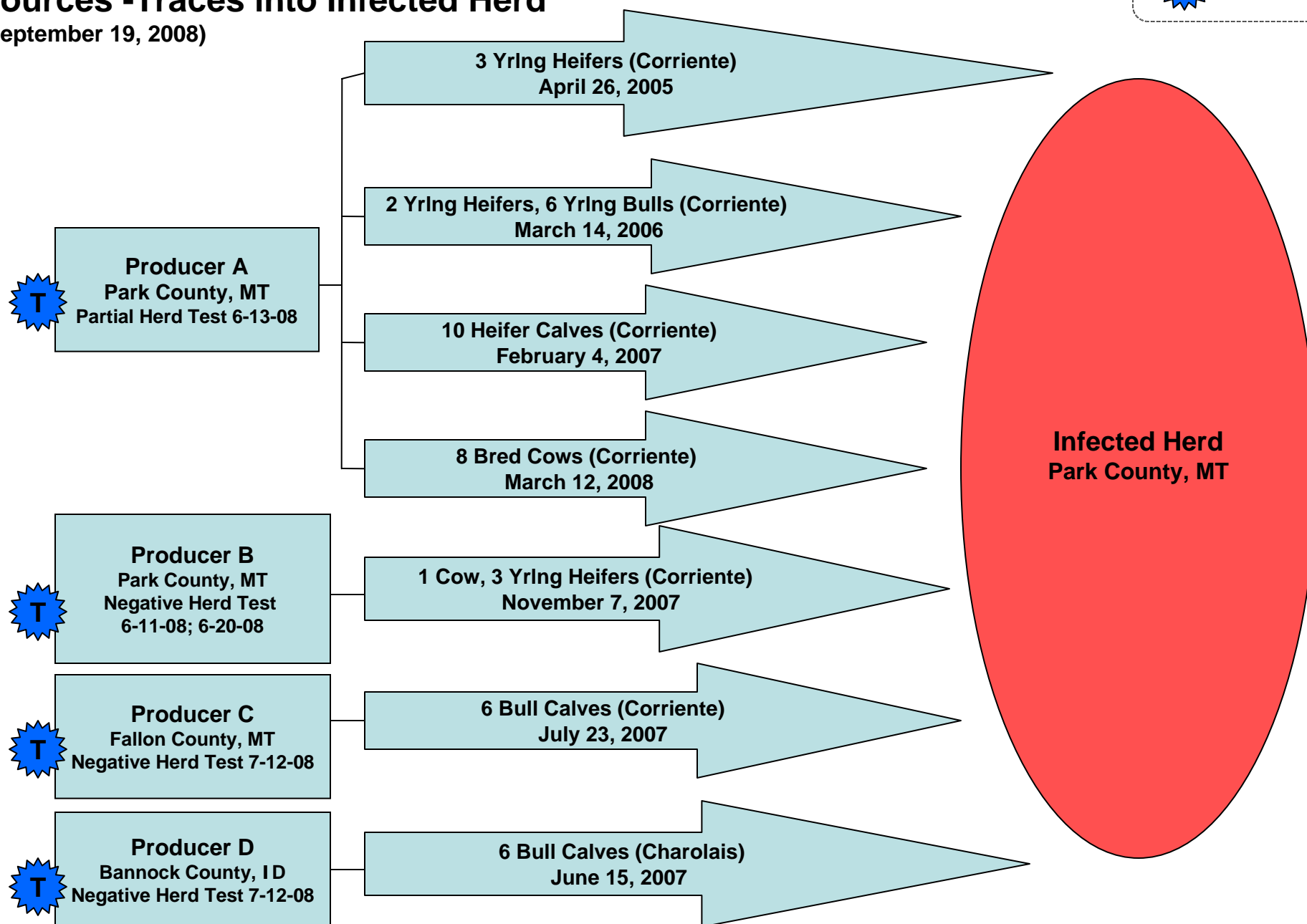
= Tested

MT BRUCELLOSIS – 2008

Sources -Traces into Infected Herd

(September 19, 2008)

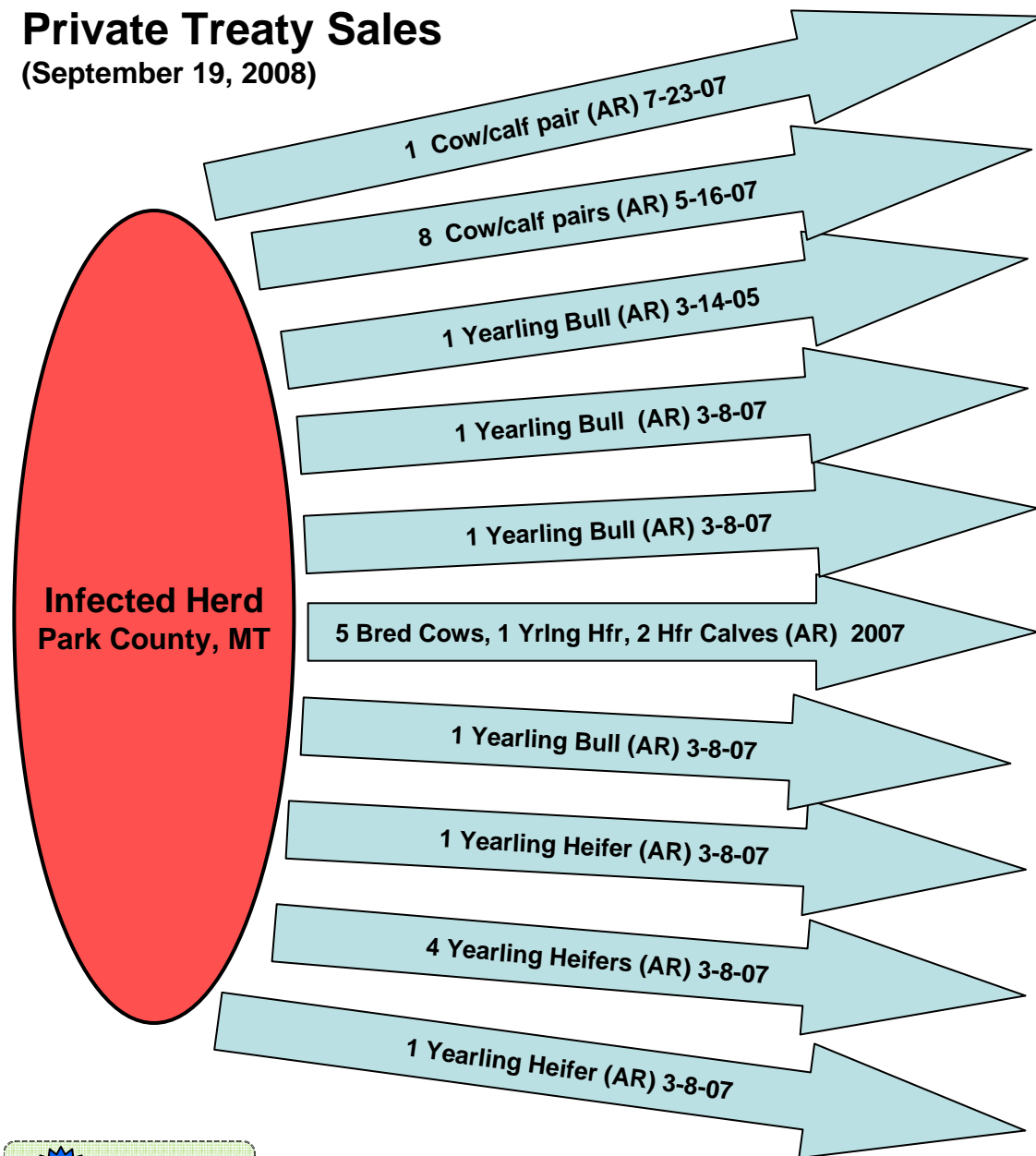
 = Tested



MT BRUCELLOSIS – 2008

Traces out of Infected Herd- Private Treaty Sales

(September 19, 2008)



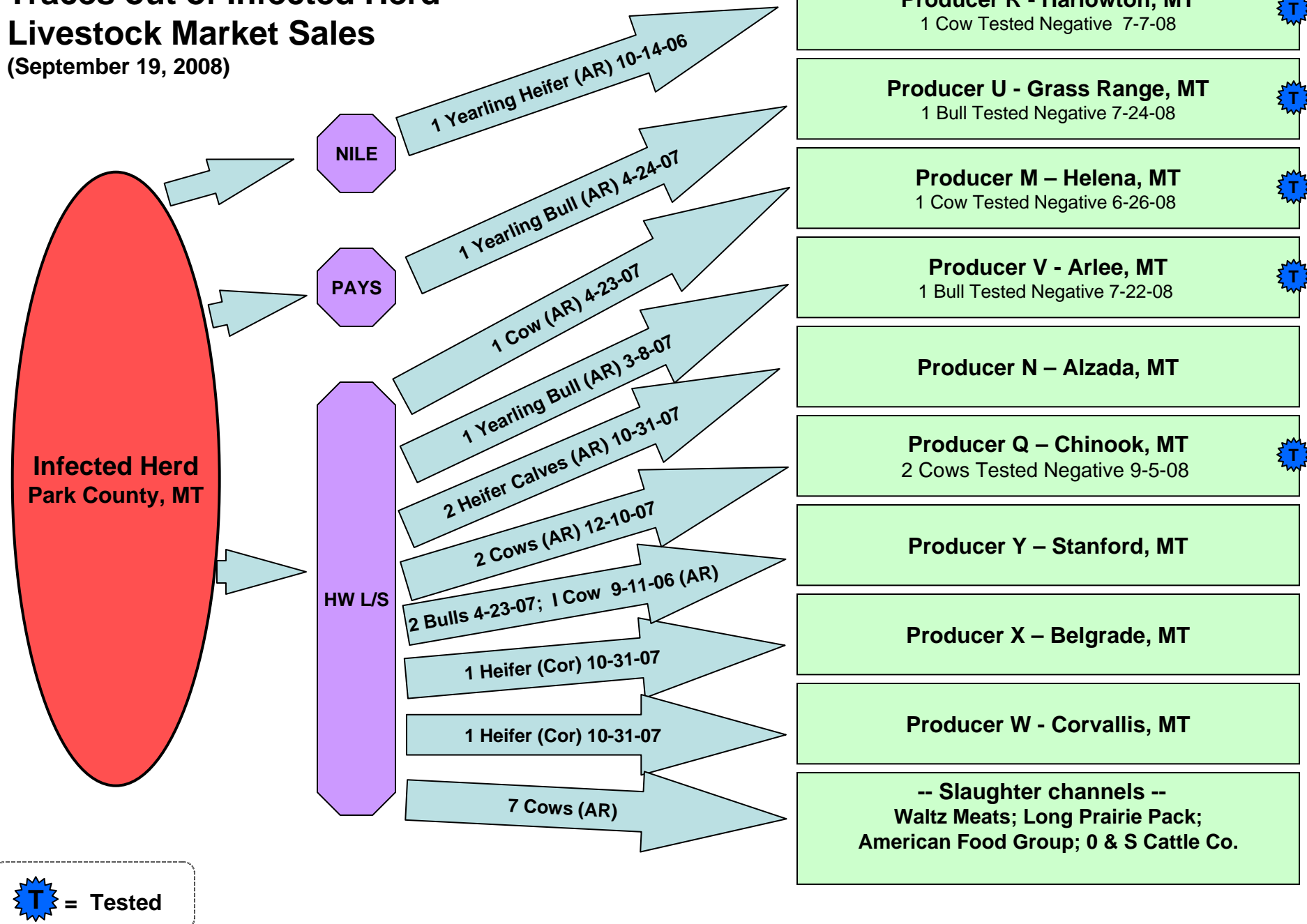
Producer K - Pray, MT Negative Herd Test (5 hd) 6-16-08	T
Producer L- Molt, MT Negative Herd Test (14 hd) 7-1-08	T
Producer P -Dodson, MT 1 Bull Tested Negative 6-21-08	T
Producer S - Wise River, MT 1 Bull Tested Negative 7-2-08	T
Producer T – Scobey, MT 1 Bull Tested Negative 7-11-08	T
Producer I - Pray, MT 5 Cows Tested Negative 5-15-08 Negative Herd Test (237 hd) 7-9-08	T
Producer XI - Blackfoot, ID 7-22-08 – Bull out on pasture – Test pending	
Producer XH - Hawi, HI 7-17-08 – Heifer isolated - Test pending	
Producer XW - Ranchester, WY Negative Herd Test (8 hd) 7-20-08	T
Producer XN - Baldwin, ND 1 Heifer Tested Negative 7-1-08	T

T = Tested

MT BRUCELLOSIS – 2008

Traces out of Infected Herd – Livestock Market Sales

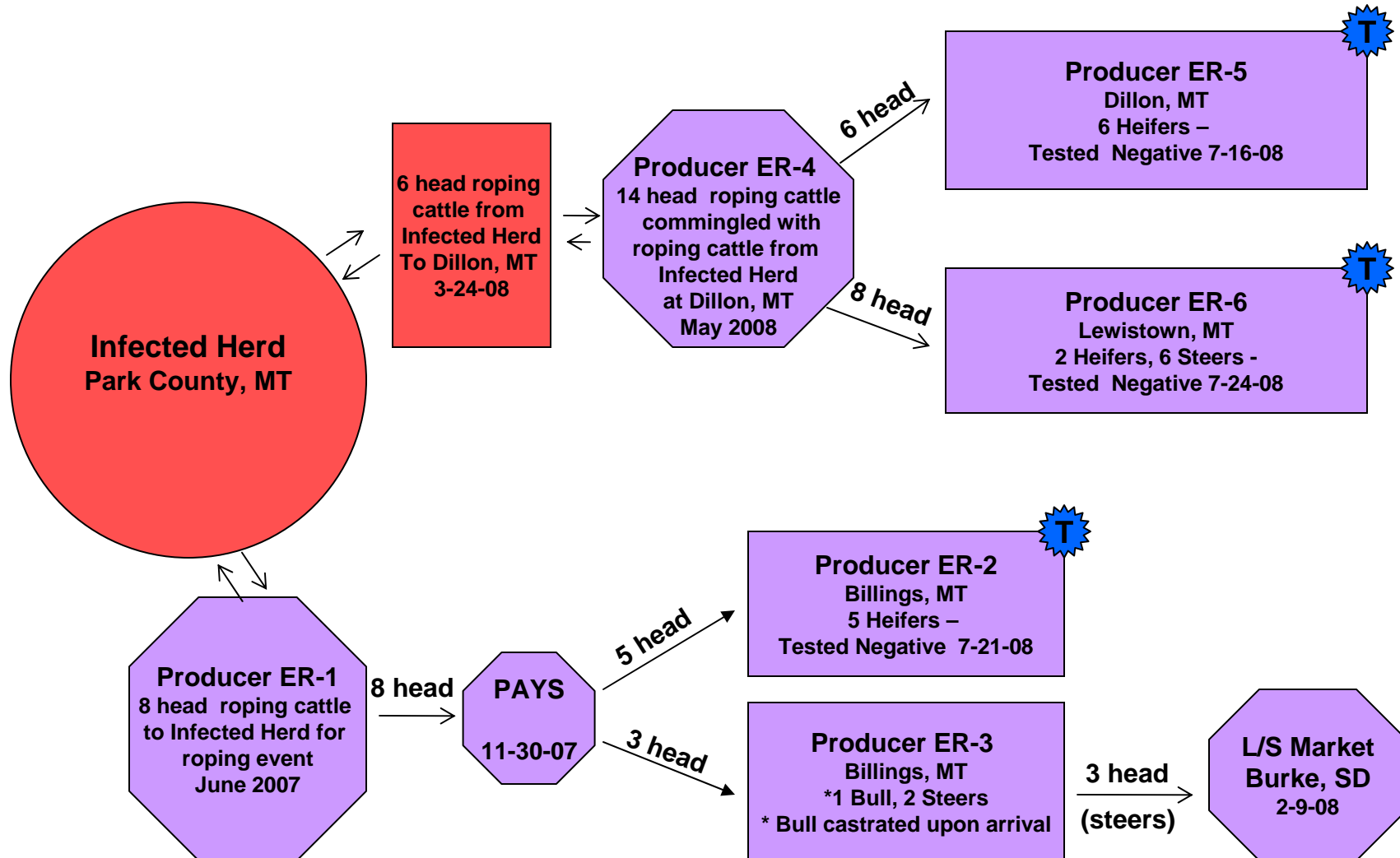
(September 19, 2008)



MT BRUCELLOSIS – 2008

Other Exposed Animals / Premises

(September 19, 2008)



T = Tested

APPENDIX B: DNA Analysis for positive Heifer and the cow identified as the Dam, confirming parentage to a Montana animal.



VETERINARY GENETICS LABORATORY
SCHOOL OF VETERINARY MEDICINE
ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8744

TELEPHONE: (530) 752-2211
FAX: (530) 752-3556

CATTLE PARENTAGE AND GENETIC MARKER REPORT

MARTIN ZALUSKI 301 N. ROBERTS HELENA, MT 59620	Case: NC10250 Date Received: 29-Jul-2008 Report Date: 06-Aug-2008 Report ID: 7340-7140-3572-3195
Name: 81TUG0218 YOB: 06 Breed: CO Sex: F	Reg: Owner ID:
Sire: Dam: NO.22 81AYJ3152	Reg: Reg:

PARENTAGE ANALYSIS

81TUG0218 qualifies as an offspring of NO.22 81AYJ3152 without consideration of the sire.

GENETIC MARKERS

LOCUS	TYPE	LOCUS	TYPE
BM1818	262	BM1824	182/188
BM2113	133/135	BRR	248
CYP21	202/212	ETH10	211/219
ETH225	148/150	INRA23	214
RM006	110	RM067	90/96
SPS115	248/260	TGLA122	161/183
TGLA126	115/117	TGLA227	83

APPENDIX C: DNA Fingerprinting (Hoofprinting) analysis performed by National Veterinary Services Laboratory (NVSL) to determine relationship of *brucella abortus* isolated from the infected heifer to other known strains of *brucella abortus*.



National Veterinary Services Laboratories
1800 Dayton Rd. , Ames, IA 50010
Phone (515) 663-7266 Fax (515) 663-7397
Brucella Genotyping Test Report

Five *Brucella abortus* biovar 1 isolates were recovered and genotyped from a single adult cow (NVSL Acc # 555145), owner ... from Pray, MT. The case was received at NVSL for culture and identification on May 28, 2008. Genotyping was performed using MLVA (Multi Locus VNTR [Variable Number Tandem Repeat] Analysis of 23 separate loci within the *Brucella* genome.

Results:

Genotyping results of these isolates indicate that the *B. abortus* strain recovered from the adult cow in Montana appears to be similar to strains recovered from bison and elk in the Greater Yellowstone Area. Figure 1 below provides a visual interpretation of this data, and was generated through a statistical modeling method termed Maximum Parsimony.

Full epidemiological information for all strains in Figure 1 is found in Table 1.

Analysis of Figure 1 indicates that the isolates in this analysis can be divided into two clusters. This is shown by the thick red line separating the top grouping from the bottom grouping. The bottom grouping contains *Brucella abortus* strains recovered from wildlife in the Greater Yellowstone Area, and the two most recent cattle isolates from Montana, recovered in 2007 and 2008. Although there is insufficient data to conclusively determine if there is more than one distinct strain of *Brucella* in Montana, this data does indicate that the Montana strains are more closely related to each other than isolate from other areas of the country (the exception being the small cluster of Idaho elk isolates from 2002 through 2005; indicated in blue/green at the bottom of the Figure). Therefore this data is consistent with transmission between livestock and wildlife in this geographical location.



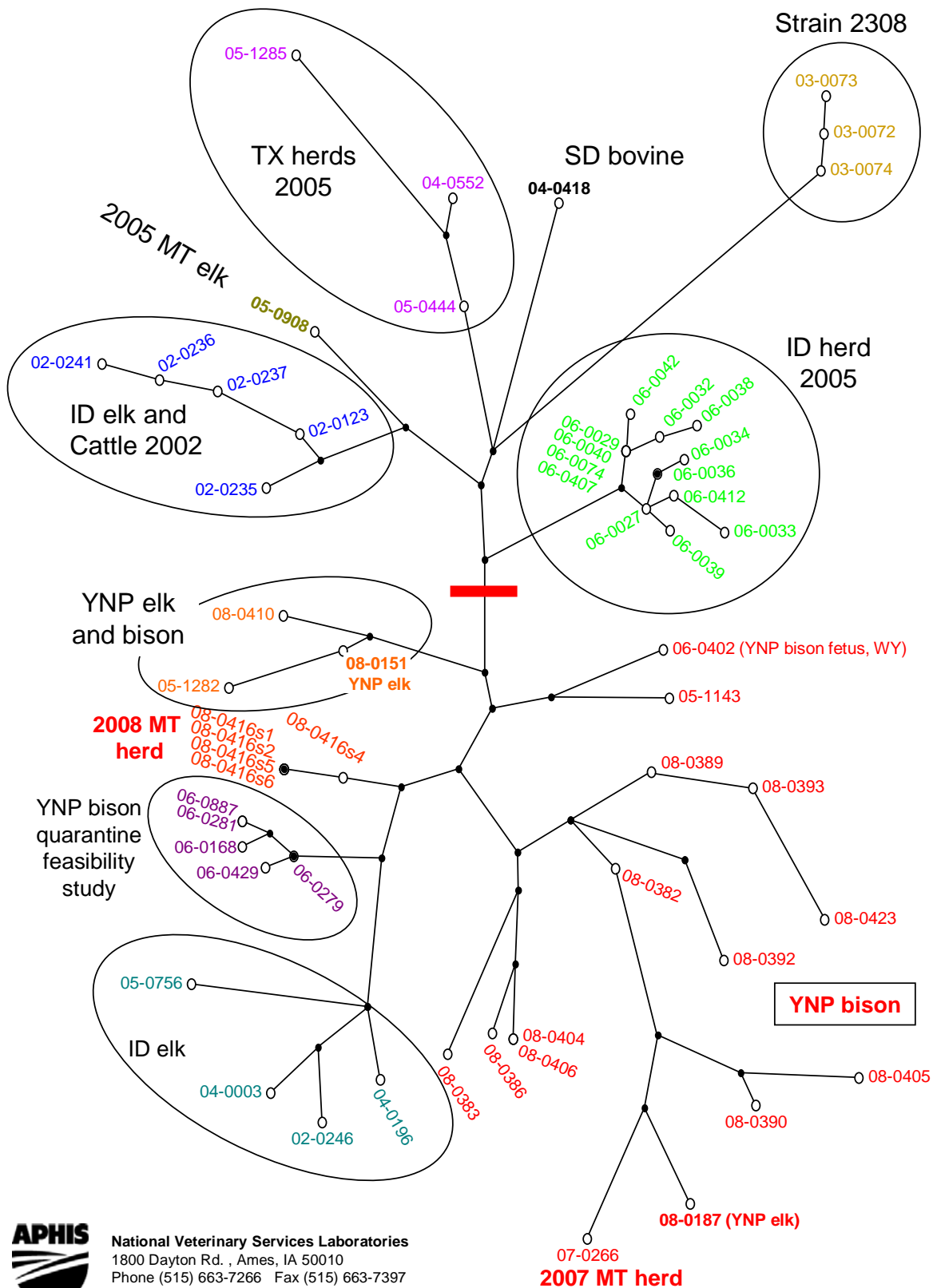
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Brucella Genotyping Test Report

Table 1. List of isolates depicted in phylogenetic tree.

NVSL Acc #	NVSL ID	Animal Species	State	Animal ID	Comments
163343	02-0123	elk	ID	60217	Conant Creek
179599	02-0235	cattle	ID	82VIU1921	2002 ID herd
179599	02-0236	cattle	ID	82ALK6225	2002 ID herd
179599	02-0237	cattle	ID	82AKN7632	2002 ID herd
179599	02-0241	cattle	ID	82VME6918	2002 ID herd
180373	02-0246	elk	ID		
243781	03-0072	elk	ID	yellow 332 (N03-060)	
243781	03-0073	elk	ID	yellow 332 (N03-060)	
243781	03-0074	elk	ID	yellow 332 (N03-060)	
278724	04-0003	elk	ID		Caldwell
278724	04-0196	elk	ID	ERO3-177	Rainey Creek - Jun 2002
324789	04-0418	cattle	SD		Cimpl Packing Co. Yankton
327720	04-0552	cattle	TX	74EME0146	2005 - TX herd # 3
354997	05-0444	cattle	TX	74EXP6760	2004 - TX herd # 1
365387	05-0756	elk	ID	4985031104	Rainey Creek - Feb 2005
370796	05-0908	elk	MT		South Fork Indian Creek
382426	05-1143	bison	MT	81 APF 6470 (1 yo F)	Corwin Springs
391747	05-1282	bison	MT	81 APH 5970 (1 yo M)	Corwin Springs
392810	05-1285	cattle	TX	74FAA0148 (milk)	2004 - TX herd # 2
406666	06-0027	cattle	ID	403	(new herd - Idaho, 2005)
406666	06-0029	cattle	ID	409	(new herd - Idaho, 2005)
406666	06-0032	cattle	ID	409	(new herd - Idaho, 2005)
406666	06-0033	cattle	ID	437	(new herd - Idaho, 2005)
406666	06-0034	cattle	ID	409	(new herd - Idaho, 2005)
408269	06-0036	cattle	ID	437	(new herd - Idaho, 2005)
408269	06-0038	cattle	ID	403	(new herd - Idaho, 2005)
408269	06-0039	cattle	ID	403	(new herd - Idaho, 2005)
408270	06-0040	cattle	ID	409	(new herd - Idaho, 2005)
408270	06-0042	cattle	ID	409	(new herd - Idaho, 2005)
453922	06-0887	bison	MT	77-06	Corwin Springs, Belgrade
419836	06-0168	bison	MT	2179	Yellowstone bison calves
426558	06-0279	bison	MT	14-06/bison	Yellowstone bison calves
426555	06-0281	bison	MT	07-06/bison	Yellowstone bison calves
433600	06-0407	cattle	ID	409 (milk)	(new herd - Idaho, 2005)
433600	06-0412	cattle	ID	437 (milk)	(new herd - Idaho, 2005)
436720	06-0429	bison	MT	sample 29-06	Yellowstone bison calves
496198	07-0266	cattle	MT	81 TSK 4771	2007 new herd - Montana
539969	08-0151	elk	MT	#17 / Madden / 08/03/1982-13-07	Bozeman
539969	08-0187	elk	MT	#53 / Rawlins / 12/24/1960-22-07 / 150.577	Bozeman
553656	08-0382	bison	MT	#27 / Bison	YNP
553658	08-0383	bison	MT	#28 / Bison	YNP
553663	08-0386	bison	MT	#33 / Bison	YNP
553670	08-0389	bison	MT	#36 / Bison	YNP
553671	08-0390	bison	MT	#37 / Bison	YNP
553674	08-0392	bison	MT	#39 / Bison	YNP
553675	08-0393	bison	MT	#40 / Bison	YNP
553707	08-0406	bison	MT	8-346 / P08-011 / Bison	Mammoth Hot Springs
555145	08-0416s1	cattle	MT	1-1340 / #601 / 81TUG0218	2008 new herd - Montana
555145	08-0416s2	cattle	MT	1-1340 / #601 / 81TUG0218	2008 new herd - Montana
555145	08-0416s3	cattle	MT	1-1340 / #601 / 81TUG0218	2008 new herd - Montana
555145	08-0416s4	cattle	MT	1-1340 / #601 / 81TUG0218	2008 new herd - Montana
555145	08-0416s5	cattle	MT	1-1340 / #601 / 81TUG0218	2008 new herd - Montana



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